Community Conservation Assessment for Riparian Cave Habitat and Associated Rare Animal Species

USDA Forest Service, Eastern Region

October 2002

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HOOSIER NATIONAL FOREST

This Conservation Assessment was prepared to compile the published and unpublished information on riparian cave habitats and associated rare animal species in the Hoosier National Forest. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community and associated taxa, please contact the Eastern Region of the Forest Service Threatened and Endangered Species Program at 310 Wisconsin Avenue, Milwaukee, Wisconsin 53203

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EXECUTIVE SUMMARY

The purpose of this document is to provide the background information necessary to prepare a Conservation Strategy, which will include management actions to conserve riparian cave habitats and communities. Presently listed as Regional Forester Sensitive Species that occur in cave riparian communities on the Hoosier National Forest are the milliped Conotyla bollmani, spider Porrhomma cavernicolum, collembolans Sinella alata, Sinella cavernarum, rove beetle Aleochara lucifuga and ground beetles Pseudanophthalmus youngi and Pseudanophthalmus stricticollis.

Rare cavernicolous species present in riparian cave communities to be recommended as Regional Forester Sensitive Species are the milliped Pseudotremia salisae, , Pseudotremia indianae, Pseudotremia undescribed species collembolan Pseudosinella fonsa, dipluran Litocampa undescribed species, ground beetle Pseudanophthalmus undescribed species (Monroe County). The federally endangered Indiana bat Myotis sodalis also occurs in the Hoosier National Forest in riparian habitat.

DESCRIPTION OF HABITAT AND COMMUNITY

Many of the caves of the Hoosier National Forest contain streams and some of the most significant troglobites in the national forest occur in the associated riparian habitat. The riparian habitat is comprised of several zones, some of which may not be present depending on the situation. Adjacent to shallow cave streams the riparian habitat at base-flow starts as exposed gravel bars. These gravel bars form relatively horizontal benches that are essentially flood plains for the streams. The next zone is typically a combination of mudbanks and exposed bedrock. Usually the mudbanks slope upward from the stream to the walls of the cave. Commonly there are two obvious zones on the mudbanks. The first is a lower zone (closer to the stream) that is flooded periodically and free of macroscopic microbial growth. The second is an obviously drier upper mudbank zone that is usually detected by the presence of white, gray and yellow patches of microbial growth. In some situations the cave stream's water spans the passage and laps against the rock walls of the cave, in which case the mudbank zone is absent. The walls form a continuous habitat, also frequently covered with patches of microbial growth, forming an arch of various sorts that comprise the ceiling of the cave.

The subterranean riparian community is comprised of different animals that inhabit the various zones. At stream level, the Pseudanopthalmus beetles are most commonly found among stream gravels and on the lower parts of mudbanks. The rove beetle Lesteva pallipes is commonly taken in significant numbers roaming gravel banks.

Much of the fauna sampled is typically taken from pitfalls placed in mudbanks, but this may be a function of pitfall placement and survival rather than faunal diversity. On the mudbanks the most common animals are usually flies, including the dung fly Spelobia tenebrarum and hump-backed fly Megaselia cavernicola. Millipeds are usually present, Pseudotremia salisae in the Little Blue River basin, and Conotyla bollmani in caves of the East Fork of White River drainage. The dipluran Litocampa undescribed species is

present in small numbers as well as a variety of collembolans, for example Sinella alata, Sinella cavernarum, Pseudosinella fonsa, Tomocerus flavescens. Predators in these mudbank communities include the pseudoscorpions, e.g., Apochthonius indianensis and the sheet-web spiders, e.g., Phanetta subterranea or Porrhomma cavernicolus. Besides the Pseudanophthalmus ground beetles, the rove beetles Aleochara lucifuga or Atheta spp. are usually present in these habitats. The Long-tailed salamander Eurycea longicauda or Cave salamander Eurycea lucifuga usually occur on mudbanks or wall ledges.

Moving up onto the rock walls of the cave the fauna decreases. Commonly found are heleomyzid flies like Amoebaleria defessa or Aecothea specus. Most members of the mudbank fauna can also be found on the walls, particularly if the humidity is high and hiding places are afforded. Starting on wall projections and continuing onto the ceiling are bats, e.g., the pipistrelle Pipistrellus subflavus, Little brown bat Myotis lucifugus or rarely, the Indiana bat Myotis sodalis.

ENVIRONMENTAL CONDITIONS

Camacho (1992) listed a number of characteristics of caves terrestrial ecosystems, noting that the environment was heterogeneous and subject to variation in most parameters:

(1) Temperature--Dependent on the latitude, altitude, cave size and ventilation. In southern Indiana the air temperature at a point about 3500 feet into the interior of Binkley Cave monitored monthly for a year varied from 53.7 to 56.3 degrees F. (Lewis and Sollman, 1998).
(2) Light—absent, thus no photosynthetic plants to supply oxygen or nutrients.
(3) Air—The flow of air into and out of a cave is linked to atmospheric factors. Normally cave air composition is the same as the outside atmosphere and is replenished regularly due to flow. In caves lacking multiple connections to the outside that allow air flow and exchange, carbon dioxide can accumulate due to decomposition and other factors.
(4) Humidity—Even caves that appear to be “dry” frequently have high relative humidity and it is not unusual for it to be between 95 to 100%. This is important since many terrestrial troglobites are stenohygrobiont and live only in environments at or near saturation.
(5) Nutrients—All food material for riparian communities must be imported. If the community is proximate to an entrance then trogloxenes may be an important source of nutrients. However, the obvious source of organic material to riparian communities is deposition of organic material in the form of detritus, etc. by flood events.

CURENT COMMUNITY CONDITION, DISTRIBUTION AND ABUNDANCE

Due to the presence of karst topography in parts of the Hoosier National Forest riparian cave habitats and their communities are relatively common. However, compared to surface riparian habitat this is a rare and somewhat sporadically located habitat. Furthermore, many of the caves of the Hoosier National Forest are comprised solely of dry, streamless passages and therefore contain no riparian habitat. Many valleys formed in the karst of the Hoosier National Forest contain a cave, although in many cases it remains unenterable to humans. In many cases riparian habitats remain in excellent condition due to limited disturbance and the restorative effects of periodic flooding.

REGIONAL FORESTER SENSITIVE SPECIES

The milliped Conotyla bollmani, spider Porrhomma cavernicolum, collembolans Sinella alata, Sinella cavernarum, rove beetle Aleochara lucifuga and ground beetles Pseudanophthalmus youngi and Pseudanophthalmus stricticollis are presently listed as Regional Forester Sensitive Species that occur in cave riparian communities on the Hoosier National Forest. Rare cavernicolous species present in cave riparian communities to be recommended as Regional Forester Sensitive Species are millipeds Pseudotremia salisae, Pseudotremia indianae, Pseudotremia undescribed species, collembolan Pseudosinella fonsa, dipluran Litocampa undescribed species, and Pseudanophthalmus undescribed species (Monroe County).

POTENTIAL THREATS

Riparian communities, due to their proximity to the cave stream, are particularly susceptible to disturbance from water-born contaminants. Potential contaminants include (1) sewage or fecal contamination, including sewage plant effluent, septic field waste, campground outhouses, feedlots, grazing pastures or any other source of human or animal waste (Harvey and Skeleton, 1968; Quinlan and Rowe, 1977, 1978; Lewis, 1993; Panno, et al 1996, 1997, 1998); (2) pesticides or herbicides used for crops, livestock, trails, roads or other applications; fertilizers used for crops or lawns (Keith and Poulson, 1981; Panno, et al. 1998); (3) hazardous material introductions via accidental spills or deliberate dumping, including road salting (Quinlan and Rowe, 1977, 1978; Lewis, 1993, 1996).

Habitat alteration due to sedimentation is a pervasive threat potentially caused by logging, road or other construction, trail building, farming, or any other kind of development that disturbs groundcover. Sedimentation potentially changes cave habitat, blocks recharge sites, or alters flow volume and velocity. Keith (1988) reported that pesticides and other harmful compounds like PCB's can adhere to clay and silt particles and be transported via sedimentation. Observation of muddy brown floodwaters entering the Wesley Chapel Gulf Cave System are testimony to potential sedimentation problems. In areas like Elrod Cave where floodwaters apparently pond, large mudbanks have been deposited. The degree to which this sedimentation is being augmented by the agricultural and other uses of the surrounding karst by man is unknown.

Impoundments may detrimentally affect cave species. Flooding destroys riparian habitats unusable and creates changes in stream flow that in turn causes siltation and drastic modification of gravel riparian habitats (Duchon and Lisowski, 1980; Keith, 1988). Conditions in some Tucker Dam Quarry Cave (Springs Valley Recreation Area) was reported to change in response to the height of the adjacent Tucker Lake (Fee, 1992b). One of the caves known from the Deam Wilderness has apparently been covered by the impoundment creating Lake Monroe.

Fire and smoke are potential sources of airborne particulate contamination and hazardous material introduction to the cave environment. Elliott (1998) reviewed the possible insecticide effects of cigarette smoke from cave visitors and the numerous harmful chemicals present in it (Feinstein, 1952; Howarth, 1983). Many caves have active air currents that serve to inhale surface air from one entrance and exhale it from another. Ashes in the entrance of Patton Cave attest to campfires being built there. This activity produces a dead zone due to the heat involved and alters the habitat as well as making smoke.

Numerous caves have been affected by quarry activities prior to acquisition. For example, the entrance to Tucker Dam Quarry Cave was apparently created by quarrying, and the original cave was cut into two pieces (Fee, 1992b). Roadcut construction for highways passing through national forest land is a similar blasting activity and has the potential to destroy or seriously modify cave ecosystems. Indirect effects of blasting include potential destabilization of passages, collapse and destruction of stream passages, changes in water table levels and sediment transport (Keith, 1988).

Cave ecosystems are unfortunately not immune to the introduction of exotic species (Elliott, 1992; 1998). Out-competition of native cavernicoles by exotic facultative cavernicoles is becoming more common, with species such as the exotic milliped Oxidus gracilis (Lewis, et al., 2002 in press) that most heavily affects riparian communities . In some cases this milliped literally over-runs the habitat with its sheer numbers.

With the presence of humans in caves comes an increased risk of vandalism or littering of the habitat, disruption of habitat and trampling of fauna, introduction of microbial flora non-native to the cave or introduction of hazardous materials, e.g., spent carbide, batteries (Peck, 1969; Elliott, 1998).

SUMMARY OF LAND OWNERSHIP AND EXISTING HABITAT PROTECTION

Numerous caves with excellent riparian habitats and communities are protected on the Hoosier National Forest. Prominent examples are: Patton Cave, Deam Wilderness, Monroe County; Elrod Cave and Wesley Chapel Gulf Cave, Wesley Chapel Gulf Special Area, Orange County; Spring Springs Cave and Dillon Cave, Little Africa area, Orange County; Rose Cave, and Gypsy Bill Allen Cave, Gypsy Bill Allen Special Area, Martin County; Mesmore Spring Cave, Hemlock Cliffs Special Area, Crawford County. Forest

service special areas and wilderness areas have restricted management criteria to protect the ecosystems within these areas (USDA Forest Service, 1991; 2000).

Within the Hoosier National Forest, riparian habitats and communities are commonly encountered in caves. There are many other fine examples of this habitat in the national forest (Lewis, et al., 2002).

SUMMARY OF MANAGEMENT AND CONSERVATION ACTIVITIES

Cave and karst habitat located on the Hoosier National Forest are subject to standards and guidelines for caves and karst protection and management as outlined in the Hoosier National Forest Land and Resource Management Plan (Forest Plan) (USDA Forest Service, 1991). These standards and guidelines include the following:

> *Caves are protected and managed in accordance with the Federal Cave and Karst Resources Protection Act of 1988, Forest Service Manual 2353, Memorandums of Understanding between the forest service and the National Speleological Society, the Indiana Karst Conservancy, Inc., the Forest Cave Management Implementation Plan, and individual specific cave management plans.
>
> *Except where modified by an existing cave management prescription, vegetation within a 150-200 foot radius of cave entrances and infeeder drainages with slopes greater than 30 percent will generally not be cut. No surface disturbing activities will be conducted on any slopes steeper than 30 percent adjacent to cave entrances. Similar protection areas will be maintained around direct drainage inputs such as sinkholes and swallow holes known to open into a cave's drainage system of any streams flowing into a known cave.
>
> *Allow no sediment from erosion of access roads and drilling sites to wash into caves or karst features.
>
> *Seismic surveys requiring explosives shall not be conducted directly over known cave passages or conduits.
>
> *All caves will be managed as significant.
>
> (USDA Forest Service, 1991)

The forest plan includes a cave and karst management implementation plan. This management plan places an emphasis on cave resource protection and mitigation. Understanding of the caves is established through mapping, bioinventory, cataloging of resources (e.g., archaeological, paleontological, speleothems, etc.), and estimating use levels and trends. Protection zones or other mitigation measures recommended by a management prescription will be established around caves entrances, sinkholes and swallowholes. Specific criteria will include consideration for protection of entrance and

cave passage microclimate, animals inhabiting the cave, physical and chemical parameters and aesthetic values associated with the cave.

RESEARCH AND MONITORING

A bioinventory of subterranean habitats of the Hoosier National Forest is being conducted in which riparian habitats are being intensively sampled (Lewis, et al., 2002; and in progress).

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